WHAT IS CLAIMED IS:

1. A process for forming a film of material from a substrate, said process comprising steps of:

introducing particles through a surface of a substrate to a selected depth underneath said surface, said particles being at a concentration at said selected depth to define a substrate material to be removed above said selected depth; and

providing energy to a selected region of said substrate to initiate a controlled cleaving action at said selected depth in said substrate, whereupon said cleaving action is made using a propagating cleave front to free a portion of said material to be removed from said substrate.

2. The process of claim 1 wherein said particles are derived from a source selected from the group consisting of hydrogen gas, helium gas, water vapor, methane, hydrogen compounds, and other light atomic mass particles.

3. The process of claim 1 wherein said particles are selected from the group consisting of neutral molecules, neutral atoms, charged molecules, charged atoms, and electrons.

4. The process of claim 1 wherein said particles are energetic.

5. The process of claim 4 wherein said energetic particles have sufficient kinetic energy to penetrate through said surface to said selected depth underneath said surface.

6. The process of claim 1 wherein said step of providing energy sustains said controlled cleaving action to remove said material from said substrate to provide a film of material.

7. The process of claim 1 wherein said step of providing energy increases a controlled stress in said material and sustains said controlled cleaving

action to remove said material from said substrate to provide a film of material.

8. The process of claim 1 wherein said introducing step forms damage selected from the group consisting of atomic bond damage, bond substitution, weakening, and breaking bonds of said substrate at said selected depth.

9. The process of claim 8 wherein said damage creates stress in said substrate material.

10. The process of claim 8 wherein said damage reduces an ability of said substrate material to withstand stress without a possibility of a cleaving of said substrate material.

11. The process of claim 1 wherein said propagating cleave front comprises a plurality of cleave fronts.

12. The process of claim 1 wherein said introducing step causes stress of said material region at said selected depth by a presence of said particles at said selected depth.

13. The process of claim 1 wherein said energy is selected from the group consisting of a thermal source, a thermal sink, a mechanical source, a chemical source, and an electrical source.

14. The process of claim 13 wherein said chemical source is provided by particles.

15. The process of claim 13 wherein said chemical source includes a chemical reaction.

16. The process of claim 13 wherein said chemical source is

selected from the group consisting of a flood source, a time-varying source, a spatially varying source, and a continuous source.

17. The process of claim 13 wherein said mechanical source is selected from the group consisting of a rotational source, a translational source, a compressional source, an expansional source, and an ultrasonic source.

18. The process of claim 13 wherein said mechanical source is selected from the group consisting of a flood source, a time-varying source, a spatially varying source, and a continuous source.

19. The process of claim 13 wherein electrical source is selected from the group consisting of an applied voltage source and an applied electro-magnetic means.

20. The process of claim 13 wherein said electrical source is selected from the group consisting of a flood source, a time-varying source, a spatially varying source, and a continuous source.

21. The process of claim 13 wherein said thermal source or said thermal sink provides energy by radiation, convection, or conduction.

22. The process of claim 21 wherein said thermal source is selected from the group consisting of a photon beam, a liquid jet, a gas jet, an electron beam, a thermo-electric heater, an oven, and a furnace.

23. The process of claim 21 wherein said thermal sink is selected from the group consisting of a liquid jet, a gas jet, a cryogenic fluid, a super-cooled liquid, a thermo-electric cooling means, and a super-cooled gas.

24. The process of claim 23 wherein said thermal source is selected

from the group consisting of a flood source, a time-varying source, a spatially varying source, or a continuous source.

25. The process of claim 1 wherein said substrate is maintained at a temperature ranging between -200°C and 450°C during said introducing step.

26. The process of claim 1 wherein said step of providing said energy is maintained at a temperature below 400°C.

27. The process of claim 1 wherein said step of providing said energy is maintained at a temperature below 350°C.

28. The process of claim 1 wherein said step of introducing is a step(s) of beam line ion implantation.

29. The process of claim 1 wherein said step of introducing is a step(s) of plasma immersion ion implantation.

30. The process of claim 1 further comprising a step of joining said surface of said substrate to a surface of a target substrate to form a stacked assembly.

31. The process of claim 30 wherein said joining step is provided by applying an electrostatic pressure between said substrate and said target substrate.

32. The process of claim 30 wherein said joining step is provided by using an adhesive substance between said target substrate and said substrate.

33. The process of claim 30 wherein said joining step is provided by an activated surface between said target substrate and said substrate.

34. The process of claim 30 wherein said joining step is provided

by an interatomic bond between said target substrate and said substrate.

35. The process of claim 30 wherein said joining step is provided by a spin-on-glass between said target substrate and said substrate.

36. The process of claim 30 wherein said joining step is provided by a polyimide between said target substrate and said substrate.

37. The process of claim 1 wherein said substrate is made of a material selected from the group consisting of silicon, diamond, quartz, glass, sapphire, silicon carbide, dielectric, group III/V material, plastic, ceramic material, and multi-layered substrate.

38. The process of claim 1 wherein said surface is planar.

39. The process of claim 1 wherein said surface is curved or annular.

40. The process of claim 1 wherein said substrate is a silicon substrate comprising an overlying layer of dielectric material, said selected depth being underneath said dielectric material.

41. The process of claim 40 wherein said dielectric material is selected from the group consisting of an oxide material, a nitride material, or an oxide/nitride material.

42. The process of claim 1 wherein said substrate includes an overlying layer of conductive material.

43. The process of claim 42 wherein said conductive material is selected from the group consisting of a metal, a plurality of metal layers, aluminum,

tungsten, titanium, titanium nitride, polycide, polysilicon, copper, indium tin oxide, silicide, platinum, gold, silver, and amorphous silicon.

44. The process of claim 1 wherein said step of introducing provides a substantially uniform distribution of particles along a plane of said material region at said selected depth.

45. The process of claim 44 wherein said substantially uniform distribution is a uniformity of less than about 5%.

46. A method for forming a film of material from a single-crystal silicon wafer, the method comprising steps of:

implanting hydrogen ions through a surface of the single-crystal silicon wafer to a selected depth underneath the surface, the hydrogen ions being at a concentration at the selected depth to define a layer to be removed above the selected depth;

bonding the surface to a workpiece; and

providing energy to a selected region of the substrate to initiate a controlled cleaving action at the selected depth in the substrate to free the layer from the substrate.

47. A device comprising a thin film of silicon, the thin film of silicon having a cleaved surface with a cleaved surface roughness less than about 60 nm.

48. The device of claim 47 wherein the thin film of silicon is less than about 15 microns thick.

49. The device of claim 47 wherein the thin film of silicon is bonded to a target wafer.

50. A method for forming a film of material from a single-crystal

silicon wafer, the method comprising steps of:

implanting hydrogen ions through a surface of the single-crystal silicon wafer to a selected depth underneath the surface, the hydrogen ions being at a concentration at the selected depth to define a layer to be removed above the selected depth; and

directing a jet of high-pressure fluid at a selected region of the substrate to initiate a controlled cleaving action at the selected depth in the substrate to free the layer from the substrate.

51. The method of claim 50 wherein the jet of high-pressure fluid is heated above a wafer temperature of the single-crystal silicon wafer.